# MAGNESIUM

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Primary magnesium was produced by one company in the United States, and much of the U.S. demand was met by imports. Canada, China, Israel, and Russia were the principal sources of imported magnesium. Diecasting, aluminum alloying, and iron and steel desulfurization, in descending order, were the principal end-use applications for magnesium in the United States in 2004.

China continued to dominate world production of primary magnesium, accounting for 73% of the total. New magnesium recovery plants were planned for Australia, Canada, Congo (Brazzaville), and Egypt, but the earliest any of this new capacity would come onstream would be in 2007.

### Legislation and Government Programs

On February 27, U.S. Magnesium LLC filed a petition with the U.S. International Trade Commission (ITC) claiming that imports of alloy magnesium from China and pure and alloy magnesium from Russia were harming the U.S. industry. After a hearing on March 19, the U.S. Department of Commerce, International Trade Administration (ITA) began an investigation into the claims. Although some magnesium from China and Russia was already subject to antidumping duties, this investigation included material not included in the first set of antidumping duties (U.S. Department of Commerce, International Trade Administration, 2004a). In 1995, the ITC had determined that imports of pure magnesium from China were injuring the U.S. magnesium industry, and set a duty rate of 108.26% ad valorem for pure magnesium, but no duty was established for alloy magnesium. After a new investigation begun in 2000, the ITC established a duty of 305.56% ad valorem as the China-wide rate (with one exception for a specific company) for granular magnesium, which was not covered by the 1995 determination. In both instances, magnesium from Russia had been investigated along with magnesium from China, but it was determined that imports of pure, alloy, and granular magnesium from Russia did not injure the U.S. industry, so no duty rates were established. In the new investigation, primary and secondary magnesium alloy, which would be classified under Harmonized Tariff Schedule (HTS) numbers 8104.19.00 and 8104.30.00 are the principal materials from China that are under investigation. For Russia, the investigation includes magnesium classified under HTS numbers 8104.11.00, 8104.19.00, and 8104.30.00. (HTS number 8104.11.00 is pure magnesium.)

On September 24, the ITA announced preliminary results of its dumping investigation of magnesium metal and alloy from China and Russia. Based on its investigation and information submitted by several Chinese magnesium producers, the ITA established the following antidumping duties for magnesium alloy classified under the HTS codes 8104.19.00 and 8104.30.00: China National Nonferrous Metals Import/Export Corp., Jiangsu Branch, 117.41% ad valorem; RSM companies, 128.11% ad valorem; Beijing Guangling Jinghua Science & Technology Co. Ltd., 140.09% ad valorem; and Tianjin Magnesium International Co. Ltd. and China-wide, 177.62% ad valorem (U.S. Department of Commerce, International Trade Administration, 2004c). For Russia, the ITA established the following rates for magnesium classified under HTS codes 8104.11.00, 8104.19.00, 8104.30.00, and 8104.90.00: Solikamsk Magnesium Works, 21.49% ad valorem; JSC Avisma Magnesium-Titanium Works, 10.62% ad valorem; and all others, 12.36% ad valorem (U.S. Department of Commerce, International Trade Administration, 2004b). Final determinations on both sets of duties were scheduled for the first quarter of 2005.

In December, the ITA announced that it would revoke the antidumping duty order on pure magnesium imported from Canada, effective August 1, 2000. The revocation was in response to the completion of the NAFTA binational panel review of its remand decisions (U.S. Department of Commerce, International Trade Administration, 2004e).

In September, the ITA published the final results of its countervailing duty administrative review of pure and alloy magnesium from Canada for calendar year 2002. The rates were the same as those established in the preliminary review—1.07% ad valorem for pure magnesium from Norsk Hydro Canada, 1.07% ad valorem for magnesium alloy from Norsk Hydro, and 1.84% ad valorem for magnesium from Magnola Metallurgy Inc. (U.S. Department of Commerce, International Trade Administration, 2004d).

### Production

U.S. Magnesium LLC planned to begin construction of a third set of electrolytic cells that would increase its capacity to 51,000 metric tons per year (t/yr) from the current level of 45,000 t/yr at its Rowley, UT, plant. The company would start bringing the new cells online in June 2005 and reach full capacity in 2006. The company planned an additional expansion to 73,000 t/yr if market conditions warrant (Platts Metals Week, 2004g).

### Environment

The cover gas sulfur hexafluoride ($SF_6$) that is used to protect molten magnesium from oxidation has been implicated as a potential factor in global warming. Although studies on its effect continue, its long atmospheric life (about 3,000 years) and high potential as a greenhouse gas (23,900 times the global warming potential of carbon dioxide) has resulted in a call for voluntary reductions in its emissions. In 1999, the U.S. magnesium industry, the International Magnesium Association, and the U.S. Environmental Protection Agency (EPA) began a voluntary partnership to understand and reduce emissions of $SF_6$. According to the EPA, emissions from primary magnesium production and magnesium casting have decreased by 45% between 1990 and 2003. The most significant decrease has taken place since 1999, mainly because of a decline in the quantity of magnesium diecast and the closure of a U.S. primary magnesium production facility (U.S. Environmental Protection Agency, 2005§[1]).

### Consumption

Reported primary magnesium consumption in 2004 increased by 19% from that in 2003 (table 3). An increase of 41% in magnesium used in diecasting applications was responsible for the overall increase in primary consumption, even though light vehicle production in the United States fell by 1.9% (WardsAuto.com, 2005§). Consumption of primary magnesium for other end-use applications did not show any significant changes. Diecasting remained the largest use for primary magnesium, accounting for 57% of the total, followed by aluminum alloying with 28% and iron and steel desulfurization with 7%. Recovery of magnesium-base old scrap fell significantly because of the closure of Garfield Alloys Inc.'s Garfield Heights, OH, recycling plant during 2004 (table 2). The plant, which was one of the leading recyclers of old magnesium scrap, was gutted by fire in December 2003.

Data for magnesium metal are collected from two voluntary surveys of U.S. operations by the U.S. Geological Survey. Of the 75 companies canvassed for magnesium consumption data, 48% responded, representing 21% of the magnesium consumption listed in tables 2 and 3. Data for the 39 nonrespondents were estimated on the basis of prior-year consumption levels and other factors. One large aluminum producer accounted for nearly one-half of the nonresponse total quantity.

In May, the Contech unit of SPX Corp. received orders for five new diecast projects, including aluminum and magnesium rack and pinion steering housings, the company's core product line. The rack and pinion steering housings will be used on several DaimlerChrysler AG vehicles including three Mercedes Benz platforms and the PT Cruiser. Production of each of the five new components will begin by January 2006 (SPX Corp., 2004§).

Magnesium recycler Halaco Engineering Co. decided to close its Oxnard, CA, plant because of its involvement in a number of Federal and State environmental lawsuits. Halaco had considered moving its operations to Tennessee, but decided to close the plant instead. The company had been operating under Chapter 11 bankruptcy since 2002 (Metal Bulletin, 2004).

### Stocks

Producers' yearend 2004 stocks of primary magnesium increased from those at yearend 2003; producer stock data were withheld to avoid disclosing company proprietary data. Consumer stocks of primary and alloy magnesium were 7,050 metric tons (t) at yearend 2004, a 7% increase from the yearend 2003 level of 6,570 t (revised). Secondary magnesium stocks increased to 2,260 t at yearend 2004 from 2,150 t at yearend 2003.

### Prices

Yearend 2004 U.S. magnesium prices were significantly higher than those at yearend 2003 (table 4). Although prices rose steadily throughout 2004, they reached their highest level at the beginning of the third quarter when the U.S. spot Western price range was $1.70 to $1.80 per pound.

Magnesium prices in China rose sharply through mid-June mainly because of high raw materials (mainly ferrosilicon), power, and freight costs. As ferrosilicon prices began to fall, magnesium metal prices in China fell as well. After an initial downturn at the end of the second quarter, magnesium prices in China increased, and by the end of July, the average China free market price was $1,845 per metric ton. In addition, the Platts Metals Week U.S. diecasting alloy AZ91D transaction price range rose significantly by mid-July to $1.10 to $1.60 per pound from $1.10 to $1.15 per pound. One reason given for the increase was because some Chinese producers reneged on their contracts when prices had begun rising earlier in the year. Consumers had to purchase metal on the spot market rather than at the original contract price. Diecasters delayed negotiating contracts for 2005 until a determination on antidumping duties was made for magnesium alloy from China and Russia (Platts Metals Week, 2004b).

In the third quarter of 2004, United States and Chinese magnesium prices increased. Several factors contributed to the increase in U.S. prices: large aluminum producers, such as Alcan Inc. and Alcoa Inc., began negotiating contracts for their 2005 magnesium needs, anticipation of a decision in the antidumping duty case on imports of magnesium from China and Russia, and the absence of low-cost Chinese magnesium in the U.S. market; magnesium from China had been sold mostly in Europe.

Press reports indicated that magnesium contract prices for 2005 would be higher than those for 2004. Most of the aluminum rolling mills were reported to have negotiated contracts for pure magnesium at $1.45 to $1.56 per pound, about 45 cents per pound higher than the 2004 contract price (Platts Metals Week, 2004e). Magnesium alloy contract prices in 2005 were reported to be about $1.45 to $1.55 per pound, about 35 to 40 cents per pound higher than in 2004 (Platts Metals Week, 2005).

[1]References that include a section mark (§) are found in the Internet References Cited section.

## Foreign Trade

Total magnesium exports for 2004 were about 42% less than those in 2003 (table 5). Canada (70%) and Mexico (20%) were the main destinations. Imports for consumption in 2004 were 18% higher than those in 2003 (table 6). Of the total quantity of magnesium imported into the United States, Canada (36%), Russia (24%), China (19%), and Israel (13%) were the principal sources in 2004. More than one-half the magnesium imported in 2004 was as alloy, and more than one-third was in the form of pure metal. Canada and China together supplied 80% of the magnesium alloy imports, and Russia and Israel provided 86% of the pure magnesium imports in 2004.

## World Review

***Australia.***—In March, the Queensland and Federal governments reached agreement on terms to exit their involvement as secured creditors with Australian Magnesium Corp. (AMC). As part of the agreement, AMC will relinquish to the government $A46.4 million, the land that would have been used as a plant site, and physical and other assets that are not required to implement the company's new business plan. AMC will retain the Queensland Magnesia Corp. (QMAG) magnesia business and its magnesite resources, the magnesium pilot plant, assets and intellectual property associated with the advanced magnesium technology process, and physical assets that could be used in developing the advanced magnesium process. According to AMC, it planned to develop three business units—the advanced magnesium technology process for alloys and semifabricated products, the QMAG business, and the development of primary magnesium production technology. The company continued to seek investors in the projects (Australian Magnesium Corp., 2004§). By December, AMC had sold its QMAG subsidiary to Resource Capital Fund III L.P. for $5.8 million.

Magnesium International Ltd. (MIL) decided to relocate its proposed 88,000-t/yr magnesium plant away from South Australia and was investigating five new sites—Callide and Stanwell in Queensland; Sokhna, Egypt; Mesaieed, Qatar; and Fujirah, United Arab Emirates. After completing feasibility studies on these five locations, MIL selected Egypt as the location for the magnesium plant. The specific site in Egypt will be inside the new port at Ain Sokhna on the Gulf of Suez. The smelter will be owned and operated by a special purpose company called Egyptian Magnesium Co. (EMAG) that was being established under Egyptian Investment Laws. The Port of Sokhna can handle and rapidly unload large bulk carriers for delivery of magnesite ore. In addition, EMAG would get a number of additional benefits from locating the smelter inside the port area, including "free zone status" conditions with no corporate tax or dividend withholding tax and access to existing port services such as power for construction, warehousing, and security. A 650-megawatt power station is adjacent to the port. The site also has access to rail transport and a road network that links the port to Cairo and Suez City. MIL received an offer for a 15-year supply of power for the smelter from the Egyptian Electricity Holding Co., an entity of the Egyptian Government. MIL planned to begin a bankable feasibility study by the first quarter of 2005 (Magnesium International Ltd., 2004§).

Latrobe Magnesium Ltd. chose to evaluate commercially proven Russian technology instead of the previously planned Alcan technology for the extraction of magnesium from Latrobe Valley fly ash. The company could not attract funding for the development phase of its bankable feasibility study based on Alcan's technology that had not been commercially proven. The Russian process was used at four magnesium production facilities around the world, and Latrobe Magnesium would be able to use an existing pilot plant in Russia for testing instead of building a new pilot plant. As a result, the feasibility study would be reduced from 29 months to 23 months, and the estimated cost reduced from $A32 million to $A15 million (Latrobe Magnesium Ltd., 2004§).

***Canada.***—In January, Timminco Ltd. had announced that it would close its Haley, Ontario, magnesium plant in the second half of 2004. In early April, however, the company decided to delay the previously announced closure because of an unanticipated increase in demand for its high-purity magnesium. The company said that the closure would be deferred until further notice (Magnesium.com, 2004b§).

In March, Gossan Resources Ltd. entered into an agreement with Hatch Associates Ltd. for the first in a series of preliminary feasibility studies of its Inwood magnesium project in Manitoba. The company began an initial economic assessment of a 50,000-t/yr magnesium plant that would use Mintek of South Africa's new atmospheric silicothermic magnesium extraction process (Gossan Resources Ltd., 2004§).

***China.***—In 2004, magnesium was produced by 136 companies in 10 Provinces, primarily by the Pidgeon process. Total ingot production was reported to be 248,000 t, compared with 182,000 t in 2003. The principal use for magnesium in China was as an alloying addition to aluminum (28%). Structural uses of magnesium (cast and wrought products) accounted for 27% of total consumption, and desulfurization of iron and steel accounted for 15%. Exports of magnesium in all forms totaled 384,000 t, of which 228,000 t was ingot. Europe, Asia, and the United States, in descending order, were the primary destinations for China's magnesium exports. The largest number of magnesium plants was in Shanxi Province, with 75. Shaanxi Province was the next with 24, and Ningxia Province had 18 (Beijing Antaike Information Development Co. Ltd., 2005).

Shanxi Wenxi Yinguang Magnesium Industry Co. Ltd. increased its primary magnesium capacity to 50,000 t/yr by installing new equipment (Beijing Antaike Information Development Co. Ltd., 2004b). Hebi Jianghai Smelting Co. Ltd. planned to increase its magnesium alloy production capacity to 36,000 t/yr from 6,000 t/yr by 2006. Construction of the first phase of the expansion, a 10,000-t/yr line, has begun and was expected to be completed by mid-2004. The company also produces magnesium anodes, chips, and powder at its Henan Province plant (Platts Metals Week, 2004c).

A new Australian-owned company, Quay Magnesium Ltd., announced that it planned to raise $31.4 million to construct a 30,000-t/yr magnesium alloy plant in China. Instead of having an integrated ingot and alloy production plant, the company planned to purchase magnesium ingot from the Chinese producers and convert it to magnesium alloy. If sufficient capital is raised, the company planned to begin production in 2006 (Magnesium.com, 2004a§).

Because of raw materials supply and power problems, some of the planned expansions in China were delayed. Shanxi Datong Zhongjin Magnesium Industry Co. delayed completion of its ingot expansion project from August until December. The expansion increased the company's capacity to 8,000 t/yr from 3,500 t/yr. In addition, Ningxia Zhongning Aluminium delayed its expansion from 2004 until 2005. The company had planned to increase its ingot production capacity to 50,000 t/yr from 15,000 t/yr (Platts Metals Week, 2004a). Minhe Magnesium Co. in Qinghai Province delayed its planned alloy capacity expansion from late 2004 until the first half of 2005. The expansion will increase the plant's magnesium alloy production capacity to 20,000 t/yr from 4,000 t/yr (Platts Metals Week, 2004d).

Yuxing Magnesium Industry Co. Ltd. stopped magnesium metal production at its 12,000-t/yr plant in Shanxi Province on November 9 because of a company shakeup. Coal and electricity shortages had curtail the plant's production to about 2,000 t in 2004. The company had planned a capacity increase to 50,000 t/yr by the end of 2005, but this was delayed indefinitely because the company's Hong Kong-based partner was short of funds. Yuxing Magnesium had no date scheduled for reopening the plant (Platts Metals Week, 2004f).

Guangling Jinghua Magnesium Industry Science and Technology Co. started up a new 20,000-t/yr magnesium alloy production line in January in Shanxi Province. The company's entire magnesium alloy output was expected to be exported. Jinghua Magnesium Industry Co. also inaugurated its 4,000-t/yr magnesium granule and powder production line in Henan Province in early 2004. The powder and granules produced at the plant were used for steel desulfurization in China (Beijing Antaike Information Development Co. Ltd., 2004a).

***Congo (Brazzaville).***—Magnesium Alloy Corp. (MagAlloy) continued to develop its proposed 60,000-t/yr Kouilou magnesium project scheduled for completion in 2007. MagAlloy formed a wholly owned subsidiary, MagEnergy Inc., to facilitate the power requirements for the Kouilou Project, such as energy generation and transmission, and in addition, MagEnergy intends to be active in upstream and downstream petroleum production and distribution in Africa. MagEnergy will be responsible for further development of the previously announced memorandum of understanding (MOU) with Eskom Enterprises Ltd. (a wholly owned subsidiary of Eskom Ltd., the state energy commission of South Africa). Under the terms of the MOU, MagAlloy and Eskom agreed to rehabilitate and develop the Inga hydroelectric plant and the transmission of power to Pointe-Noire. In addition, MagEnergy entered into an MOU to construct a new electrical transmission line connecting Inga to MagAlloy's plant site. MagAlloy also signed an MOU with Germany's Ferrostaal AG to provide engineering, procurement, and construction services for the Kouilou plant. Under the terms of the agreement, Ferrostaal would act as MagAlloy's principal contractor (Magnesium Alloy Corp., 2004a§, c§).

In June, MagAlloy signed a technology access agreement with the Russian National Aluminum and Magnesium Institute, State Titanium Research and Design Institute, and Aluminum Alloys and Metallurgical Process LLC, which gives MagAlloy regionally exclusive rights for the application of a number of patented magnesium extraction technologies including dehydration and electrolysis technologies (Magnesium Alloy Corp., 2004b§).

In late 2004, MagAlloy restructured its operations into five separate subsidiaries to develop different business segments. These subsidiaries will be incorporated under the new name MagIndustries Corp. The five subsidiaries are MagMetals Inc. to develop the Kouilou Magnesium smelter project at Pointe-Noire; MagEnergy Inc. to manage all the company's power projects; MagEnergy International Inc. to carry out oil-product trading in West Africa; MagMinerals Inc. to develop and produce agricultural-grade potash fertilizers and food-industry-grade salt and calcium chloride from the Kouilou salt deposits; and MagAlloy Congo SA, a Congo (Brazzaville) corporation, to develop and operate the Mengo brine mining field, which will provide the raw materials for both MagMetals and MagMinerals. MagAlloy Congo SA would be owned 90% by MagAlloy and 10% by the Government of Congo (Brazzaville) (Magnesium Alloy Corp., 2004d§).

***Germany.***—IMCO Recycling Inc. announced that its German subsidiary VAW-IMCO Guss und Recycling GmbH will start operations in December at a new facility that will recover magnesium from scrap. About 90% of the output of the plant, which is being built next to IMCO's existing Toeging facility, will be provided to the European auto industry. The magnesium plant will have a rated capacity of 15,000 t/yr and was expected to begin operating at a rate of 5,000 t/yr in the first quarter of 2005. It will produce cast magnesium ingots from the recycled scrap (IMCO Recycling Inc., 2004§). In December, IMCO Recycling Inc. merged with Commonwealth Industries Inc. to create a new firm, Aleris International Inc.

Hydro Magnesium inaugurated the 7,500-t/yr expansion of its Bottrop recycling plant in September. This expansion doubled the plant's capacity to 15,000 t/yr.

***Russia.***—Construction of the Asbest Magnesium Plant was expected to begin by the end of 2005 in Asbest, Sverdlovsk Oblast, Russia. Switzerland's Minmet Financing Co. and the Sverdlovsk regional government were the plant's cofounders. The new plant, which will recover magnesium from serpentinite tailings from a nearby asbestos mine, will be constructed in three stages of 20,000 t/yr each. Plant construction was scheduled to be completed by 2008 (Interfax Mining and Metals Report, 2004).

## Current Research and Technology

A team of undergraduate aerospace engineering students at the University of Michigan conducted research to help astronauts make fuel once they get to Mars. At the National Aeronautics and Space Administration's Johnson Space Center in Houston, the students conducted zero-gravity experiments using iodine as a catalyst to burn magnesium. Magnesium is found in minerals on Mars and can be extracted for fuel—fossil fuels do not burn on Mars because of the planet's carbon dioxide ($CO_2$) atmosphere; metals, however, do burn in a $CO_2$ atmosphere. Preliminary results from the student experiments showed that using iodine as a catalyst helped make the magnesium burn better. The experiments also showed that the iodine-magnesium-$CO_2$ system worked even better in a microgravity environment, which is significant because the gravity on Mars is about one-third that of Earth (University of Michigan, 2004§).

Magnesium Elektron (a subsidiary of the Luxfer Group) announced that it developed the world's largest magnesium anode weighing 5.5 t, which was designed to protect marine structures and pipelines from seawater corrosion. The company developed a design and a magnesium alloy microstructure that allows the anode to be consumed in a highly controlled manner when placed in a seawater environment. This enables the anode to deliver a consistent electrical current to the connected steel structure, protecting it in the seawater environment for many years. A smaller version of the anode has been evaluated in a large offshore oilfield by one of the world's leading oil companies (Magnesium Elektron, 2004§).

## Outlook

Through April 2005, magnesium alloy imports from China, one of the largest sources in recent years, have fallen to about one-quarter of the level in 2004—a reflection of the impact of the high antidumping duties imposed by the ITC. Although during the same time period, imports of magnesium alloy from Canada have increased by more than one-third, to bring the total imports to about the same quantity as those through April 2004. If Canada can continue to replace the quantity of magnesium that has been imported from China into the United States in the past and U.S. Magnesium's plant expansion is completed on schedule, supplies should be sufficient to meet U.S. demand.

Although new primary magnesium plants were planned for Australia, Canada, Congo (Brazzaville), and Egypt, the earliest plant that would be onstream would be the one in Congo (Brazzaville), scheduled for 2007. Considering that plants originally scheduled to be onstream in 2003 and 2004 have been either canceled or postponed, this timetable seems optimistic; the Congo (Brazzaville) plant was originally scheduled to be onstream in 2005. China, however, continues to construct new primary metal and alloy plants, and most likely will continue to dominate in primary magnesium production.

According to a paper presented by Norsk Hydro at the 2005 International Magnesium Association conference, the world market for magnesium grew by 8% from 2003 to 2004. The total market was estimated to have increased to 410,000 t from 380,000 t. As in previous years, the diecasting segment was the main growth area in 2004, increasing by 13% compared with that in 2003, and aluminum alloying demand increased by 4%. Demand for magnesium alloys for diecasting grew in all regions in 2004, reaching a total of 152,000 t. Asian consumption increased by 17%; North American, 12%; and European, 9%. Structural and interior automotive components accounted for the strongest growth in 2004, including parts such as front-end modules and seats. Demand for magnesium in instrument panels in North America, traditionally an important application area, reached 23,000 t in 2004, which appeared to be approaching a peak volume. New applications in powertrain components, such as BMW's 6-cylinder hybrid crankcase and DaimlerChrysler's 7-speed transmission housing, were successfully introduced in 2004. Demand for castings for laptop computer housings, cell phones, and other electronic components remained stable, although increasingly this activity is concentrated in Asia.

Europe was expected to emerge as the leading region for magnesium consumption, although demand in Asia was increasing quickly. If demand in China surges as its economy continues to grow, then Asia could become the leading magnesium-consuming region. Magnesium demand was forecast to exceed 500,000 t by the end of the decade, an increase from 410,000 t in 2004. Automotive demand for magnesium was expected to drive growth, but at a slower rate than earlier. This forecast is dependent on the success or failure of new parts expanding into other car models (Webb, 2005§).

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TABLE 1
SALIENT MAGNESIUM STATISTICS[1]

(Metric tons unless otherwise specified)

| | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| United States: | | | | | |
| Production: | | | | | |
| Primary magnesium | W | W | W | W | W |
| Secondary magnesium | 82,300 | 65,800 | 73,600 | 70,100 r | 72,100 |
| Exports | 23,800 | 19,600 | 25,400 | 20,400 | 11,800 |
| Imports for consumption | 91,400 | 68,500 | 88,000 | 83,400 | 98,700 |
| Consumption, primary | 104,000 | 95,700 | 102,000 | 103,000 r | 122,000 |
| Yearend stocks, producer | W | W | W | W | W |
| Price[2] dollars per pound | 1.23-1.30 | 1.21-1.28 | 1.10-1.22 | 1.10-1.17 | 1.55-1.60 |
| World, primary production | 422,000 r | 428,000 r | 452,000 r | 496,000 r | 584,000 e |

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data.
[1]Data are rounded to no more than three significant digits.
[2]Source: Platts Metals Week.

TABLE 2
MAGNESIUM RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY KIND OF SCRAP AND FORM OF RECOVERY[1]

(Metric tons)

| | 2003 | 2004 |
|---|---|---|
| KIND OF SCRAP | | |
| New scrap: | | |
| Magnesium-base | 11,000 | 15,800 |
| Aluminum-base | 33,700 | 35,800 |
| Total | 44,700 | 51,600 |
| Old scrap: | | |
| Magnesium-base | 6,880 | 822 |
| Aluminum-base | 18,500 r | 19,700 |
| Total | 25,400 r | 20,500 |
| Grand total | 70,100 r | 72,100 |
| FORM OF RECOVERY | | |
| Magnesium alloy ingot[2] | W | W |
| Magnesium alloy castings | 792 | 1,920 |
| Magnesium alloy shapes | 290 | 353 |
| Aluminum alloys | 52,400 r | 55,700 |
| Other[3] | 16,600 | 14,100 |
| Total | 70,100 r | 72,100 |

[r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Other."
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes secondary magnesium content of both secondary and primary alloy ingot.
[3]Includes chemical and other dissipative uses, cathodic protection, and data indicated by symbol W.

TABLE 3

U.S. CONSUMPTION OF PRIMARY MAGNESIUM, BY USE[1]

(Metric tons)

| Use | 2003 | 2004 |
| --- | --- | --- |
| For structural products: | | |
| Castings: | | |
| Die | 49,100 r | 69,100 |
| Permanent mold | 71 | 112 |
| Sand | 394 | 391 |
| Wrought products[2] | 3,190 | 2,240 |
| Total | 52,800 r | 71,800 |
| For distributive or sacrificial purposes: | | |
| Aluminum alloys | 33,800 | 33,900 |
| Cathodic protection (anodes) | 3,720 | 3,520 |
| Iron and steel desulfurization | 8,130 | 8,360 |
| Reducing agent for titanium, zirconium, hafnium, uranium, beryllium | 930 | 934 |
| Other[3] | 3,340 | 3,580 |
| Total | 50,000 | 50,300 |
| Grand total | 103,000 r | 122,000 |

[r]Revised.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes sheet and plate and forgings.

[3]Includes chemicals; nodular iron; and scavenger, deoxidizer, and powder.

TABLE 4
YEAREND MAGNESIUM PRICES

| Source | | 2003 | 2004 |
|---|---|---|---|
| Platts Metals Week: | | | |
| U.S. spot Western | dollars per pound | 1.10-1.17 | 1.55-1.60 |
| U.S. spot dealer import | do. | 1.05-1.10 | 1.40-1.55 |
| European free market | dollars per metric ton | 1,850-1,950 | 1,850-1,900 |
| Metal Bulletin: | | | |
| European free market | do. | 1,850-1,950 | 1,890-1,940 |
| China free market | do. | 1,650-1,660 | 1,730-1,750 |

TABLE 5
U.S. EXPORTS OF MAGNESIUM, BY COUNTRY[1]

| Country | Waste and scrap | | Metal | | Alloys (gross weight) | | Powder, sheets, tubing, ribbons, wire, other forms (gross weight) | |
|---|---|---|---|---|---|---|---|---|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| 2003: | | | | | | | | |
| Canada | 4,880 | $11,300 | 4,580 | $7,370 | 1,840 | $4,980 | 1,670 | $6,780 |
| Japan | 14 | 34 | 59 | 142 | 19 | 194 | 146 | 1,340 |
| Mexico | 28 | 71 | 5 | 14 | 261 | 1,910 | 1,790 | 8,730 |
| Netherlands | 10 | 26 | 3,920 | 7,730 | (2) | 3 | 35 | 95 |
| United Kingdom | 13 | 101 | 133 | 219 | 2 | 33 | 383 | 7,450 |
| Other | 93 | 234 | 74 | 238 | 202 | 1,220 | 234 | 3,930 |
| Total | 5,030 | 11,800 | 8,770 | 15,700 | 2,330 | 8,330 | 4,260 | 28,300 |
| 2004: | | | | | | | | |
| Canada | 4,450 | 10,400 | 1,730 | 3,690 | 1,210 | 3,990 | 842 | 4,600 |
| Japan | -- | -- | 1 | 26 | 43 | 222 | 142 | 1,700 |
| Mexico | 151 | 427 | -- | -- | 158 | 782 | 2,020 | 6,980 |
| Netherlands | 43 | 109 | -- | -- | (2) | 10 | (2) | 43 |
| United Kingdom | -- | -- | 10 | 28 | 23 | 143 | 359 | 7,950 |
| Other | 153 | 402 | 21 | 78 | 314 | 2,630 | 166 | 4,550 |
| Total | 4,790 | 11,300 | 1,760 | 3,830 | 1,750 | 7,780 | 3,530 | 25,800 |

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 6

U.S. IMPORTS FOR CONSUMPTION OF MAGNESIUM, BY COUNTRY[1]

| | Waste and scrap | | Metal | | Alloys (magnesium content) | | Powder, sheets, tubing, ribbons, wire, other forms (magnesium content) | |
|---|---|---|---|---|---|---|---|---|
| Country | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| 2003: | | | | | | | | |
| Canada | 10,100 | $14,600 | 2,320 | $6,650 | 21,100 | $61,800 | 1,030 | $8,790 |
| China | 156 | 215 | 89 | 175 | 11,900 | 20,900 | 63 | 228 |
| Israel | -- | -- | 4,790 | 11,500 | 893 | 2,360 | -- | -- |
| Russia | -- | -- | 18,000 | 31,100 | 3,400 | 6,370 | 1 | 12 |
| Other[r] | 5,900 | 7,260 | 2,110 | 4,130 | 1,450 | 7,470 | 72 | 1,300 |
| Total | 16,200 | 22,000 | 27,300 | 53,600 | 38,800 | 98,900 | 1,160 | 10,300 |
| 2004: | | | | | | | | |
| Canada | 10,000 | 15,600 | 1,850 | 6,390 | 22,900 | 69,600 | 900 | 7,410 |
| China | 228 | 429 | 18 | 57 | 18,100 | 45,900 | 75 | 301 |
| Israel | -- | -- | 8,790 | 24,500 | 4,140 | 15,700 | -- | -- |
| Russia | -- | -- | 20,700 | 40,500 | 2,500 | 5,400 | 146 | 972 |
| Other | 1,420 | 1,580 | 2,890 | 6,820 | 3,850 | 15,200 | 75 | 1,500 |
| Total | 11,700 | 17,600 | 34,300 | 78,200 | 51,500 | 152,000 | 1,200 | 10,200 |

[r] Revised. -- Zero.

[1] Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 7
WORLD ANNUAL PRIMARY MAGNESIUM
PRODUCTION CAPACITY, DECEMBER 31, 2004[1, 2]

(Metric tons)

| Country | Capacity |
|---|---|
| Brazil | 12,000 |
| Canada | 120,000 |
| China | 447,000 |
| India | 900 |
| Israel | 27,500 |
| Kazakhstan | 10,000 |
| Russia | 40,000 |
| Serbia and Montenegro | 5,000 |
| Ukraine | 15,000 |
| United States | 45,000 |
| Total | 722,000 |

[1]Includes capacity at operating plants as well as at plants on standby basis.

[2]Data are rounded to no more than three significant digits; may not add to total shown.

TABLE 8

MAGNESIUM: PRIMARY WORLD PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

| Country | 2000 | 2001 | 2002 | 2003 | 2004[e] |
|---|---|---|---|---|---|
| Brazil[e] | 5,700 | 5,500 | 6,000 | 6,000 | 6,000 |
| Canada[e, 3] | 80,000 [r] | 83,000 [r] | 88,000 [r] | 54,000 [r] | 54,000 |
| China[e] | 190,000 | 200,000 | 250,000 | 340,000 | 426,000 |
| France[e] | 16,500 | 4,000 | -- | -- | -- |
| Israel | 31,700 | 34,000 | 28,000 [r] | 28,000 [r, e] | 28,000 |
| Kazakhstan[e] | 10,380 [4] | 16,000 | 18,000 | 14,000 | 18,000 |
| Norway[e] | 41,400 [4] | 36,000 | 10,000 | -- | -- |
| Russia[e, 3] | 45,000 | 48,000 | 50,000 | 52,000 | 50,000 |
| Serbia and Montenegro | 1,270 [r] | 1,630 | 1,695 | 1,600 [e] | 1,600 |
| Ukraine[e] | 3 | 3 | 3 | 3 | 3 |
| United States | W | W | W | W | W |
| Total | 422,000 [r] | 428,000 [r] | 452,000 [r] | 496,000 [r] | 584,000 |

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total."
-- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through July 20, 2005.

[3]Includes scecondary.

[4]Reported figure.